WHAT IS CLAIMED:

1. An adaptive control method for an electronic ratio shift controller for a multiple ratio transmission, the transmission comprising gear elements defining plural torque flow paths between a torque input shaft and a torque output shaft, and pressure-actuated friction elements selectively establishing an upshift in gear ratio as an oncoming friction element and an offgoing friction element are applied and released, the upshift having adaptive shift characteristics including the time required to fill a pressure-actuated friction element with pressure fluid, the offgoing friction element pressure of the start of a ratio change, and the oncoming friction element pressure needed to begin a ratio change, the control method comprising the steps of:

applying boost time to the oncoming friction element at the start of an upshift in substantial synchronism with a reduction in pressure for the offgoing friction element;

controlling the duration that the boost time is applied to the oncoming friction element;

controlling pressure for the offgoing friction element to an offgoing friction element starting pressure corresponding approximately to friction element torque capacity below which the offgoing friction element will begin to slip prior to a torque transfer between the friction elements;

controlling pressure for the oncoming friction element from a boost time value to an oncoming friction element starting pressure value required to begin an upshift;

monitoring measured operating conditions during a current upshift; and

adjusting the adaptive shift characteristics for a subsequent upshift as determined by the measured operating conditions, whereby upshift quality is enhanced.

2. The adaptive control method set forth in claim 1 including the steps of detecting a tie up before torque transfer during a current shift; and

reducing the pressure boost time on the oncoming friction element to reduce the tie up during a subsequent shift.

3. The adaptive control method set forth in claim 1 including the steps of detecting flare before torque transfer during a current shift; and

increasing starting pressure for the offgoing friction element to reduce flare during a subsequent shift.

4. The adaptive control method set forth in claim 1 including the steps of detecting an aggressive ramping of starting pressure of the oncoming friction element if a ratio change does not begin within a precalibrated time after the oncoming friction element starting pressure is reached during a current shift;

detecting flare before torque transfer during a current shift; and

increasing starting pressure for both the offgoing and oncoming friction elements whereby flare before torque transfer is reduced during a subsequent shift.

5. The adaptive control method set forth in claim 1 including the steps of detecting flare before torque

transfer and a large tie up before torque transfer during a current shift; and

increasing offgoing friction element starting pressure and reducing pressure boost time whereby both flare before torque transfer and a large tie up before torque transfer can be reduced during a subsequent shift.

6. The adaptive control method set forth in claim 1 including the steps of detecting flare before torque transfer and a small tie up before torque transfer during a current shift; and

increasing offgoing friction element starting pressure and reducing pressure boost time whereby flare before torque transfer and a small tie up are reduced during a subsequent shift.

7. The adaptive control method set forth in claim 1 including the steps of detecting flare before torque transfer, a small tie up before torque transfer and an aggressive ramping of starting pressure of the oncoming friction element during a current shift; and

increasing offgoing friction element starting pressure, reducing pressure boost time and increasing oncoming friction element starting pressure to reduce flare before torque transfer during a subsequent shift to avoid reaching an aggressive ramping of starting pressure of the oncoming friction element during a subsequent shift and to reduce a small tie up before torque transfer during a subsequent shift.

8. The adaptive control method set forth in claim 1 including the steps of detecting an aggressive ramping of

starting pressure of the oncoming friction element during a current shift; and

increasing starting pressure of the oncoming friction element to avoid an aggressive ramping of the oncoming friction element during a subsequent shift.

9. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer and an aggressive ramping of starting pressure of the oncoming friction element during a current shift; and

increasing starting pressure of the oncoming friction element to avoid a small tie up before torque transfer and an aggressive ramp during a subsequent shift.

10. The adaptive control method set forth in claim 1 including the steps of detecting flare during torque transfer and an aggressive ramping of starting pressure of the oncoming friction element during a current shift; and

increasing oncoming friction element starting pressure and increasing pressure boost time to reduce flare during torque transfer and to avoid reaching an aggressive ramp during a subsequent shift.

11. The adaptive control method set forth in claim 1 including the steps of detecting slip time of the oncoming friction element and an excessive ramping of starting pressure of the oncoming friction element during a current shift; and

increasing oncoming starting pressure of the oncoming friction element and decreasing offgoing starting pressure of the offgoing friction element to increase slip

time of the oncoming friction element to avoid a tie up, and to avoid an aggressive ramp during a subsequent shift.

12. The adaptive control method set forth in claim 1 including the steps of detecting an excessive ramping of starting pressure of the oncoming friction element, a small tie up before torque transfer and slip time of the oncoming friction element during a current shift; and

increasing starting pressure of the oncoming friction element and decreasing the offgoing starting pressure to avoid an aggressive ramping, a small tie up before torque transfer and a slip time for the oncoming friction element that is too short during a subsequent shift.

13. The adaptive control method set forth in claim 1 including the steps of detecting an excessive ramping of starting pressure of the oncoming friction element, a small tie up before torque transfer, a flare during torque transfer, and slip time for the oncoming friction element; and

increasing starting pressure of the oncoming friction element during a current shift to avoid an aggressive ramping, a small tie up, a flare during torque transfer and a slip time for the oncoming friction element that is too short during a subsequent shift.

14. The adaptive control method set forth in claim 1 including the steps of detecting flare before torque transfer and slip time of the oncoming friction element; and

increasing pressure boost time and increasing oncoming friction element pressure during a current shift to

reduce flare and slip time of the oncoming friction element during a subsequent shift.

15. The adaptive control method set forth in claim 1 including the steps of detecting flare during torque transfer and slip time of the oncoming friction element; and

increasing pressure boost time and oncoming friction element start pressure during a current shift to reduce flare during torque transfer and slip time of the oncoming friction element during a subsequent shift.

16. The adaptive control method set forth in claim 1 including the steps of detecting flare during torque transfer and slip time for the oncoming friction element during a current shift; and

increasing pressure boost time and increasing the oncoming friction element starting pressure to reduce flare during torque transfer and to increase slip time for the oncoming friction element during a subsequent shift.

17. The adaptive control method set forth in claim 1 including the steps of detecting flare during torque transfer and a small tie up before torque transfer during a current shift; and

increasing offgoing friction element starting pressure to avoid flare during torque transfer and a small tie up before torque transfer during a subsequent shift.

18. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer, flare before torque transfer and slip time for the oncoming friction element during a current shift; and

increasing starting pressure of the oncoming friction element to avoid a small tie up before torque transfer, flare during torque transfer and excessive slip time for the oncoming friction element during a subsequent shift.

19. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer, flare during torque transfer and slip time for the oncoming friction element during a current shift; and

decreasing oncoming friction element starting pressure and increasing offgoing friction element starting pressure;

whereby a small tie up before torque transfer, a flare before torque transfer and a slip time for the oncoming friction element that is too short are avoided during a subsequent shift.

20. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer during a current shift; and

reducing pressure boost time to avoid a small tie up during a subsequent shift.

21. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer and a negative controller effort during a current shift; and

reducing pressure boost time and decreasing oncoming friction element pressure to avoid a small tie up before torque transfer and a negative controller effort during a subsequent shift.

22. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer and a positive controller effort during a current shift; and

reducing pressure boost time and increasing starting pressure for the oncoming friction element;

whereby a small tie up and positive controller effort are avoided during a subsequent shift.

23. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up and slip time for the oncoming friction element during a current shift; and

reducing pressure boost time and increasing starting pressure for the oncoming friction element;

whereby a small tie up is avoided and slip time for the oncoming friction element is reduced during a subsequent shift.

24. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer, slip time of the oncoming friction element and negative controller effort during a current shift; and

reducing pressure boost and decreasing oncoming friction element starting pressure to avoid a small tie up, to shorten slip time for the oncoming friction element and to avoid a negative controller effort during a subsequent shift.

25. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up

before torque transfer and slip time for the oncoming friction element; and

reducing boost time and decreasing oncoming friction element starting pressure to avoid a small tie up and to avoid a slip time for the oncoming friction element that is too short.

26. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer and slip time for the oncoming friction element during a current shift; and

reducing pressure boost time and decreasing oncoming friction element starting pressure;

whereby a small tie up before torque transfer is avoided and slip time for the oncoming friction element is increased during a subsequent shift.

27. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer, slip time for the oncoming friction element and a negative controller effort during a current shift; and

reducing pressure boost time and decreasing oncoming friction element starting pressure by the larger of pressures indicated by controller effort and slip time;

whereby a small tie up is avoided, slip time for the oncoming friction element is increased and negative controller effort is avoided during a subsequent shift.

28. The adaptive control method set forth in claim 1 including the steps of detecting a small tie up before torque transfer, slip time for the oncoming friction

element and a positive controller effort during a current shift; and

reducing pressure boost time and decreasing oncoming friction element starting pressure by the larger of pressures indicated by controller effort and slip time;

whereby a small tie up is avoided, slip time for the oncoming friction element is increased and positive controller effort is avoided during a subsequent shift.

29. The adaptive pressure control method set forth in claim 1 including the steps of detecting a small tie up, slip time for the oncoming friction element and positive controller effort during a current shift; and

reducing pressure boost time and increasing oncoming friction element starting pressure to avoid a slip time that is too short and a positive controller effort during a subsequent shift.

30. The adaptive control method set forth in claim 1 including the steps of detecting slip time for the oncoming friction element during a current shift; and

increasing oncoming friction element starting pressure during a current shift;

whereby slip time for the oncoming friction element is reduced during a subsequent shift.

31. The adaptive control method set forth in claim 1 including the steps of detecting slip time for the oncoming friction element and a negative controller effort during a current shift; and

decreasing starting pressure for the oncoming friction element;

whereby slip time for the oncoming friction element is decreased and negative controller effort is avoided during a subsequent shift.

32. The adaptive control method set forth in claim 1 including the steps of detecting slip time for the oncoming friction element and positive controller effort during a current shift; and

increasing starting pressure for the oncoming friction element by the larger of the pressures indicated by controller effort and slip time;

whereby slip time for the oncoming friction element is reduced and positive controller effort is avoided during a subsequent shift.

33. The adaptive control method set forth in claim 1 including the steps of detecting slip time for the oncoming friction element during a current shift; and

decreasing starting pressure for the oncoming friction element;

whereby slip time for the oncoming friction element is increased during a subsequent shift.

34. The adaptive control method set forth in claim 1 including the steps of detecting slip time for the oncoming friction element and a negative controller effort during a current shift; and

decreasing oncoming friction element starting pressure by the larger of the pressures indicated by controller effort and slip time during a current shift;

whereby negative controller effort is avoided and slip time for the oncoming friction element is increasing during a subsequent shift.

35. The adaptive control method set forth in claim 1 including the steps of detecting slip time and a positive controller effort during a current shift; and

increasing starting pressure of the oncoming friction element;

whereby slip time for the oncoming friction element is increased and a positive controller effort is avoided during a subsequent shift.

36. The adaptive control method set forth in claim 1 including the steps of detecting an initial slip time error for the oncoming friction element during a current shift; and

changing the starting pressure for the oncoming friction element and decreasing the starting pressure of the offgoing friction element;

whereby the initial slip time error is reduced.

37. The adaptive control method of claim 1 including the step of measuring at least one of a set of measured operating conditions during a current shift event including:

a tie-up before torque transfer, indicating an early shift due to overboosting of the oncoming clutch;

a flare before torque transfer;

an aggressive ramp of pressure for the oncoming friction element, indicating low oncoming starting pressure on the oncoming clutch;

a tie-up, indicating an overboost of the oncoming friction element;

flare during torque transfer;

initial slip time from a start of a ratio change to a predetermined amount of slip;

overall slip time during a ratio shift;

whether no flare occurs, indicating offgoing friction element pressure can be reduced, and closed-loop control time for controlling pressure on the oncoming friction element; and

adjusting one or more of the adaptive shift characteristics during a subsequent shift event in response to changes in the measured operating conditions.

38. The adaptive control method of claim 37 including the step of prioritizing pressure adjustments and time adjustments for the friction elements whereby at least one of the characteristics of the subsequent shift event, including pressure boost time for the oncoming friction element, starting pressure for the offgoing friction element and starting pressure for the oncoming friction element can be changed by using measured operating conditions in a predetermined order of priority.

39. The adaptive control method of claim 38 wherein the step of prioritizing pressure adjustments and time adjustments includes using more than one operating condition measurement to simultaneously effect adaptive changes in the shift characteristics for a subsequent shift event.

40. The adaptive method set forth in claim 1 including the steps of detecting whether the measured operating conditions are within predetermined calibrated values during a current shift; and

decreasing offgoing friction element starting pressure to a base calibration value if no flare before torque transfer is present during a subsequent shift event.

41. The adaptive control method set forth in claim 37 including the steps of detecting whether the measured operating conditions are within predetermined calibrated values during a current shift; and

decreasing offgoing friction element starting pressure to a base calibration value if no flare before torque transfer is present.